

WHAT IS CLAIMED IS:

1. A system for converting solid biomass material to usable heat energy and related byproducts comprising in combination:

an air separator for separating oxygen from air and providing a supply of oxygen,

a solid fuel combustion chamber having a first chamber portion with an airlock inlet feed for feeding a metered amount of solid fuel thereto, said first burner stage having a first traveling conveyor firebelt and means for feeding oxygen from said supply along the length of said first traveling conveyor firebelt,

a second burner stage having a second traveling conveyor firebelt and means for feeding oxygen from said supply along the length of said second traveling conveyor firebelt,

a third burner stage constituting a steam boiler having a firetube for collecting fuel gases from said first burner and said second burner stages and combusting the collected fuel gases with oxygen from said separator and means to generate steam from the heat of combustion in said third burner stage and a heat utilization device connected to said steam boiler.

2. The system defined in claim 1 including means to add a controlled amount of a nitrogen-free diluent gas to oxygen in the combustion chamber and to moderate the

burning temperatures to prevent overheating of the refractory and boiler components.

3. The system defined in claim 2 wherein said diluent gas is carbon dioxide from said separator.

4. The system defined in claim 3 wherein the amount of said diluent and addition is controlled by the firetube and boiler temperatures, respectively.

5. A zero emission solid fuel fed combustion system comprising an air separator for separating oxygen from air and providing a supply of oxygen, a solid fuel combustion chamber having a first chamber portion with an airlock inlet feed for feeding a metered amount of a solid fuel thereto, a first burner stage having a first traveling conveyor firebelt, means for feeding oxygen from said supply in progressively increasing proportions along the length of the first traveling conveyor firebelt, a second burner stage having a second traveling conveyor firebelt fed with oxygen from said supply in a progressively decreasing amount along the length of said second traveling conveyor firebelt, a third burner stage constituting a steam boiler having a collector for collecting fuel gases from said first and second burner stage and combusting the collected fuel gases with oxygen from said separator and means to generate steam from the heat of combustion in said

third burner stage, and a utilization device connected to said steam boiler.

6. A solid fuel fed gasification system comprising a first chamber having an airlock infeed for feeding a metered amount of solid fuel thereto,

5 a first burner stage having a first traveling conveyor firebelt with a first oxygen-introducing means for introducing a metered amount of oxygen in progressively increasing proportions along the lengths of said first traveling conveyor,

10 at least one additional burner stage having at least one additional traveling conveyor firebelt with a second oxygen introducing means for introducing oxygen in progressively decreasing amounts along the length of said further traveling conveyor firebelt,

15 a steam boiler connected to said gasification chamber for receiving gaseous products resulting from the combustion of said solid fuel,

means for introducing oxygen into said boiler for converting the thermal energy to steam,

20 a cyclone and baghouse for particulate collection and a scrubber for removing noxious gaseous from the exhaust stream.

7. In a biomass combustion system for converting biomass to energy and useful products, a combustion method

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comprising feeding said biomass into a combustion chamber  
through an airlock and supplying oxygen and a nitrogen-free  
5 diluent to said biomass to control the combustion process  
in said combustion chamber.

8. The method defined in claim 7 wherein said  
nitrogen-free diluent gas is selected from carbon dioxide  
and argon and mixtures thereof.

9. The method defined in claim 7 including the step  
of collecting and passing combustion gas from said  
combustion chamber through a firetube and adding more  
oxygen and a diluent gas to control the burning of said  
5 combustion gas to produce heat, supplying said heat to a  
boiler to convert the heat to steam.

10. The method defined in claim 9 including passing  
residual gases through a cyclone to remove and collect  
coarse fly-ash and supplying any residual exhaust gas to a  
baghouse to remove and collect fine fly-ash therefrom and  
5 feeding gases from said baghouse to an acid gas scrubber to  
collect and remove said gas salts, and feeding gases to a  
carbon dioxide scrubber to remove carbon dioxide therefrom  
and feeding the carbon dioxide from said carbon dioxide  
scrubber to a liquifier to liquify carbon dioxide and

10           feeding said carbon dioxide from said carbon dioxide  
scrubber to said first combustion stage to as a diluent  
gas.